LIQUID SAMPLING VALVE

CROSS-REFERENCE TO RELATED PATENTS

This invention is an improvement to liquid transfer valve constructions such as disclosed and claimed in U.S. Pat. Nos. 4,507,977, 4,445,391 and 4,152,391 and owned by the Assignee herein. Each of these patents are incorporated by reference herein for the purpose of illustrating in detail the liquid transfer valves in which the invention herein is capable of being employed.

BACKGROUND OF THE INVENTION

This invention relates generally to liquid transfer valves particularly but not limited to those of the rotary operating type for measuring and dispensing precise microliter volumes of samples whereby a pair of measuring chambers is established in a series coupled relationship which is capable of providing simultaneously a pair of precisely measured liquid volumes and directing each to a pair of different predetermined locations, each along with a respective known volume of diluent.

More particularly, the invention provides internal passage means formed in select facing surfaces of said valve elements for isolating the passageways from the periphery of said valve elements so as to prevent liquid from reaching the circumferential exterior of the valve along said facing surfaces.

The liquid transfer metering and transfer valves such as provided in applicant's prior U.S. Pat. Nos. 4,445,391, 4,507,977 and 4,152,391 each include coaxially arranged disc members having opposite faces frictionally engaged and at least one being rotatable relative to the others.

A problem has been encountered involving the occurance of leakage apparently occasioned by liquids such as blood or diluent passing to the faces of the discs surrounding the junction between the communicating passageways and drying at the periphery of said disc surfaces. In addition to requiring disassembly of the valve assembly for cleaning with greater than normal frequency, the valve operation manifests an erratic relative rotation of the valve disc members.

Thus a need has arisen to provide means for materially reducing the frequency of maintenance by preventing such leakage, if it occurs, from traveling to the periphery of the engaged faces. Further and highly desirable is to provide means whereby the interior faces of the valve disc elements can be cleaned automatically.

The only solutions at hand in an effect to alleviate this problem were to cause the discs to be held together in face to face engagement extraordinarily tight making operation of the rotatable one of said elements extremely difficult, if not impossible. Unusual stress results on the parts which increases wear on the faces and causes premature life thereof.

SUMMARY OF THE INVENTION

An improvement in liquid transfer and/or diluting valves of the type which include at least a pair of valve elements having frictionally engaged faces and axially directed passageways each communicating in junctions at the faces; a continuous cleaning channel formed in one of the engaged faces extending substantially about the periphery of said one face but spaced inwardly thereof and bore means communicating to the end portions of the channel and to a source of rinse fluid, said channel substantially isolating the said junctions from the periphery of said faces whereby to prevent material from passing along the faces to the periphery of said faces.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is an exploded view of a liquid transfer metering and transfer valve having the improvement of the invention incorporated therein;

FIGS. **2**, **2A** and **2B**, respectively, illustrates the inner face, a side elevational sectional view taken along lines **2A—2A** of FIG. **2** and an outer face view of one of the respective stationary members of the valve assembly according to the invention;

FIGS. **3**, **3A** and **3B**, respectively, illustrate the outer face, a side elevational sectional view taken along lines **3A—3A** of FIG. **3** and the inner face, respectively, of the other one of the stationary members of the valve assembly according to the invention;

FIGS. **4**, **4A** and **4B** respectively illustrate the one face, a side elevational view taken along lines **4A—4A** of FIG. **4**, and the opposite face of the center inner movable member, respectively, of the valve assembly according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENT

The invention herein will be described particularly as embodied in one of several liquid transfer valves of the type disclosed and claimed in the referenced patents. It should be understood that the invention can be employed with great advantage in those liquid transfer valve constructions which include at least a pair of valve elements having frictionally engaged faces. Passageways formed in the valve discs communicate at their junctions and liquid is passed through said passageways. The junctions of the passageways occur at the engaged faces, with rotation of the valve element causing shifting of the passageways changing the communication of one with another, as will be explained hereinafter. The invention provides a continuous cleaning channel formed in one element face, preferably one of the sandwiching disc faces, the channel functioning as a cleaning channel arranged to isolate the passageway junctions from the periphery of the engaged faces whereby to collect any leakage which may occur at the junctions preventing passage thereof to the periphery of the faces. Suitable passageway and port means are formed in the valve element communicating with the opposite ends of the continous channel whereby rinsing can be effected by introducing the rinse fluid at one end for discharge at the opposite end.

The liquid transfer valve assembly contemplated herein is capable of delivering from a single sample at least two microliter segments, preferably simultaneously, for dilution with predetermined volumes of diluent, here the segments are of different volume respectively. Passages are provided for establishing two sets of fluid paths, one set defining paths for traversal by a predetermined volume of diluent, the other set defining a series connection of a pair of precise measuring chambers of different volumes, one of which is provided by a segmenting passageway formed in the inner or movable valve element and the other being provided by an external hollow loop secured fixedly to one of the stationary members. The external loop and the feeder passageways have precise internal dimensions, preferably holding a volume in the microliter range.